CLAIMS:

What is claimed is:

1. A method for reducing charging damage to a substrate in a plasma processing system comprising the steps:

coupling a first power to said plasma processing system to process said substrate using a first plasma; and

coupling a second power to said plasma processing system, wherein said second power is selected to reduce the accumulation of negative charge on at least one surface of said plasma processing system arising from applying said first power.

2. The method as recited in claim 1, wherein said second power is less than said first power.

3. The method as recited in claim 1, wherein said second power corresponds to a secondary electron yield greater than unity from at least one of said at least one exposed surface.

4. The method as recited in claim 1, wherein said coupling of said second power follows said coupling of said first power without extinguishing said plasma.

5. The method as recited in claim 1, further comprising:

extinguishing said first plasma corresponding to said coupling of said first power; and

forming a second plasma, wherein said coupling of said second power forms said second plasma.

6. The method as recited in claim 1, further comprising:

coupling a third power to said plasma processing system; and

continuing to process said substrate using said third power.

7. The method as recited in claim 6, wherein said third power is less than said second power.

8. The method as recited in claim 6, wherein said coupling of said third power follows said coupling of said second power without extinguishing said first plasma.

9. The method as recited in claim 8, wherein said third power is less than or equal to said first power.

10. The method as recited in claim 5, further comprising:

coupling a third power to said plasma processing system, wherein said coupling of said third power follows said coupling of said second power without extinguishing said second plasma; and

continuing to process said substrate using said third power.

11. The method as recited in claim 9, further comprising:

extinguishing said second plasma corresponding to said coupling of said second power;

coupling a third power to said plasma processing system, wherein said coupling of said third power forms a third plasma; and

continuing to process said substrate using said third power.

12. The method as recited in claim 1, wherein said coupling of said first power to said plasma processing system alternates with said coupling of said second power to said plasma processing system during said processing of said substrate.

13. The method as recited in claim 1, wherein said first power is greater than approximately 1000 W.

14. The method as recited in claim 7, wherein said third power is less than approximately 500 W.

15. The method as recited in claim 1, wherein said second power is selected to reduce the accumulation of negative charge on said substrate.

16. The method as recited in claim 1, wherein said second power is selected to reduce the accumulation of negative charge on an electrode.

17. The method as recited in claim 1, wherein said second power is selected to reduce the accumulation of negative charge on a substrate holder.

18. The method as recited in claim 1, wherein at least one of the exposed surfaces comprises silicon.

19. The method as recited in claim 1, wherein at least one of the exposed surfaces comprises alumina.

20. The method as recited in claim 1, wherein said second power is greater than approximately 80 W and less than approximately 1310 W.

21. The method as recited in claim 1, wherein said second power is greater than approximately 115 W and less than approximately 1060 W.

22. The method as recited in claim 1, wherein said second power is greater than approximately 205 W and less than approximately 840 W.

23. The method as recited in claim 1, wherein said second power is greater than approximately 260 W and less than approximately 640 W.

24. The method as recited in claim 1, wherein said second power is greater than approximately 400 W and less than approximately 640 W.

25. The method as recited in claim 3, wherein said secondary electron yield greater than unity corresponds to a range of electron energy from ε_{min} to

ε_{max}, and said second power corresponds to $(\varepsilon/C)^2$, wherein ε comprises an electron energy in said range and C comprises a constant.

26. The method as recited in claim 25, wherein said constant ranges from approximately a value of 10 to 20.

27. The method as recited in claim 26, wherein said constant is approximately 14.

28. The method as recited in claim 25, wherein said minimum electron energy is approximately 125 eV, and said maximum electron energy is approximately 500 eV.

29. The method as recited in claim 25, wherein said range of electron energy further comprises a peak electron energy ε_{peak}, said peak electron energy corresponds to a peak in the secondary electron yield.

30. The method as recited in claim 29, wherein said peak electron energy is approximately 250 eV.

31. The method as recited in claim 29, wherein said second power corresponds to an electron energy ranging from approximately the peak electron energy minus 10% to the peak electron energy plus 50%.

32. The method as recited in claim 29, wherein said second power corresponds to an electron energy ranging from approximately the peak electron energy minus 20% to the peak electron energy plus 60%.

33. A method for reducing negative charge on exposed surfaces within a plasma processing chamber comprising the steps:

introducing an ionizable gas into said plasma processing chamber; and

forming a plasma by coupling an intermediate power to said ionizable gas, wherein said intermediate power causes a secondary electron yield to be greater than unity from at least one of said exposed surfaces.

34. The method as recited in claim 33, wherein said exposed surfaces comprise at least one substrate holder surface.

35. The method as recited in claim 33, wherein said exposed surfaces comprise at least one electrode surface.

36. The method as recited in claim 33, wherein said exposed surfaces comprise at least one silicon surface.

37. The method as recited in claim 33, wherein at least one of the exposed surfaces comprises silicon.

38. The method as recited in claim 33, wherein at least one of the exposed surfaces comprises alumina.

39. The method as recited in claim 33, wherein said intermediate power is greater than approximately 80 W and less than approximately 1310 W.

40. The method as recited in claim 33, wherein said intermediate power is greater than approximately 260 W and less than approximately 640 W.

41. A method for reducing charging damage to a substrate in a plasma processing system comprising the steps:

introducing an ionizable gas;

forming a plasma from said ionizable gas;

exposing said substrate to said plasma; and

processing said substrate by coupling an intermediate power to said plasma processing system, wherein said intermediate power reduces the

accumulation of negative charge on a substrate surface exposed to said plasma in said plasma processing system.

42. The method as recited in claim 41, wherein said second power is greater than approximately 80 W and less than approximately 1310 W.

43. The method as recited in claim 41, wherein said second power is greater than approximately 115 W and less than approximately 1060 W.

44. The method as recited in claim 41, wherein said second power is greater than approximately 205 W and less than approximately 840 W.

45. The method as recited in claim 41, wherein said second power is greater than approximately 260 W and less than approximately 640 W.

46. The method as recited in claim 41, wherein said second power is greater than approximately 400 W and less than approximately 640 W.

47. The method as recited in claim 41, wherein said intermediate power corresponds to a secondary electron yield greater than unity from said substrate surface.

48. The method as recited in claim 47, wherein said secondary electron yield greater than unity corresponds to a range of electron energy from ε_{min} to ε_{max}, and said second power corresponds to $(\varepsilon/C)^2$, wherein ε comprises an electron energy in said range and C comprises a constant.

49. The method as recited in claim 48, wherein said constant ranges from approximately a value of 10 to 20.

50. The method as recited in claim 49, wherein said constant is approximately 14.

51. The method as recited in claim 48, wherein said minimum electron energy is approximately 125 eV, and said maximum electron energy is approximately 500 eV.

52. The method as recited in claim 48, wherein said range of electron energy further comprises a peak electron energy ε_{peak}, said peak electron energy corresponds to a peak in the secondary electron yield.

53. The method as recited in claim 52, wherein said peak electron energy is approximately 250 eV.

54. The method as recited in claim 52, wherein said second power corresponds to an electron energy ranging from approximately the peak electron energy minus 10% to the peak electron energy plus 50%.

55. The method as recited in claim 52, wherein said second power corresponds to an electron energy ranging from approximately the peak electron energy minus 20% to the peak electron energy plus 60%.

56. A method for reducing charging damage to a substrate in a plasma processing system comprising the steps:

identifying at least one exposed surface in said plasma processing system;

providing a secondary electron emitter surface on at least one of the at least one exposed surface, wherein said secondary electron emitter surface comprises a material having a secondary electron yield greater than unity for a range of energy levels;

introducing an ionizable gas to said plasma processing system;

forming a plasma from said ionizable gas;

exposing a substrate to said plasma; and

coupling said intermediate power to said plasma processing system to process said substrate, wherein said intermediate power corresponds to an energy level within said range of energy levels.

57. A plasma processing system for reducing charging damage to a substrate comprising:

a plasma processing chamber to contain a plasma, said plasma processing chamber comprising at least one exposed surface in contact with said plasma; and

at least one secondary electron emitter coupled to at least one of the at least one exposed surface, wherein said secondary electron emitter comprises a material having a secondary electron yield greater than unity.

58. A method for reducing charging damage to a substrate in a plasma processing system comprising the steps:

exposing said substrate to a plasma;

coupling a first power to said plasma processing system to process said substrate; and

coupling a second power to said plasma processing system, wherein said second power is selected to reduce the accumulation of electric charge on one or more surfaces exposed to said plasma in said plasma processing system.

59. The method as recited in claim 58, wherein said second power is less than said first power.

60. The method as recited in claim 58, wherein said second power corresponds to a secondary electron yield from at least one of said exposed surfaces greater than unity.

61. The method as recited in claim 58, wherein said coupling of said second power follows said coupling of said first power without extinguishing said plasma.

62. The method as recited in claim 58, wherein said coupling of said first power is terminated and said plasma is extinguished, and said coupling of said second power forms a second plasma.

63. The method as recited in claim 58, wherein said method further comprises coupling a third power to said plasma processing system to post-process said substrate.

64. The method as recited in claim 63, wherein said third power is less than said second power.

65. The method as recited in claim 63, wherein said coupling of said third power follows said coupling of said second power without extinguishing said plasma.

66. The method as recited in claim 62, wherein said method further comprises coupling a third power to said plasma processing system to post-process said substrate.

67. The method as recited in claim 66, wherein said coupling of said third power follows said coupling of said second power without extinguishing said second plasma.

68. The method as recited in claim 66, wherein said coupling of said second power is terminated and said second plasma is extinguished, and said coupling of said third power forms a third plasma.

69. The method as recited in claim 58, wherein said coupling of said first power to said plasma processing system alternates with said coupling of said second power to said plasma processing system during said processing of said substrate.

70. The method as recited in claim 58, wherein said first power is greater than 1000 W.

71. The method as recited in claim 64, wherein said third power is less than 500 W.

72. The method as recited in claim 58, wherein said second power is greater than 50 W and less than 1500 W.

73. The method as recited in claim 58, wherein said second power is substantially 600 W.

74. The method as recited in claim 58, wherein said second power is higher than said first power.

75. The method as recited in claim 58, wherein said second power is selected to reduce the accumulation of negative charge on one or more surfaces exposed to said plasma in said plasma processing system.

76. The method as recited in claim 58, wherein said second power is selected to reduce the accumulation of positive charge on one or more surfaces exposed to said plasma in said plasma processing system.

77. A method for reducing accumulated electric charge on exposed surfaces within a plasma processing system comprising the steps:

introducing an ionizable gas; and

applying an RF power level that provides a decrease in charge accumulation by utilizing electron energies in the range such that the secondary electron yield from said exposed surfaces is different from electron energies corresponding to previous electric charge accumulation.

78. The method as recited in claim 77, wherein said accumulated electric charge is negative, and the applied RF power level facilitates a secondary electron yield from said exposed surfaces greater than unity.

79. The method as recited in claim 77, wherein said accumulated electric charge is positive, and the applied RF power level facilitates a secondary electron yield from said exposed surfaces less than unity.

80. A method for minimizing charging damage to a substrate in a plasma processing system comprising the steps:

introducing an ionizable gas;

forming a plasma from said ionizable gas;

exposing said substrate to said plasma; and

processing said substrate by coupling an RF power to said plasma processing system, wherein said RF power minimizes the accumulation of electric charge on one or more surfaces exposed to said plasma in said plasma processing system.

81. The method as recited in claim 80, wherein said accumulated electric charge is negative, and the applied RF power is at an intermediate level that minimizes the accumulation of negative electric charge on at least one surface exposed to said plasma in said plasma processing system.

82. The method as recited in claim 80, wherein said accumulated electric charge is positive, and the applied RF power is at a level that minimizes the accumulation of positive electric charge on at least one surface exposed to said plasma in said plasma processing system.

83. A method for minimizing charging damage to a substrate in a plasma processing system comprising the steps:

identifying one or more exposed surfaces in said plasma processing system;

disposing a secondary electron emitter on at least one of said one or more exposed surfaces, wherein said secondary electron emitter comprises a material having a secondary electron yield greater than unity;

introducing an ionizable gas to said plasma processing system;

forming a plasma from said ionizable gas;

exposing a substrate to said plasma; and

coupling said intermediate power to said plasma processing system to process said substrate, wherein said intermediate power corresponds to said secondary electron yield greater than unity for at least one of said one or more exposed surfaces.

84. A plasma processing system for minimizing charging damage to a substrate comprising:

a plasma processing chamber to contain a plasma, said plasma processing chamber comprising one or more exposed surfaces in electrical contact with said plasma;

at least one secondary electron emitter coupled to at least one of said one or more exposed surfaces, wherein said secondary electron emitter comprises a material having a secondary electron yield greater than unity.

85. A plasma processing system for minimizing charging damage to a substrate as recited in claim 84, further comprising one or more electrodes coupled to said plasma processing chamber and configured to facilitate formation of said plasma.

86. A plasma processing system for minimizing charging damage to a substrate as recited in claim 84, wherein the inductive method is used to produce the plasma in the said plasma processing chamber.